everywhere attendance is compulsory until fourteen for boys, though in some places girls are allowed to leave at thirteen.

This last point is the one I wish to emphasize. The great defect—I might almost call it the fatal defect—of our system is that it stops just at a time when real education should begin. It allows a child to leave school at an age when its learning is soon forgotten and its discipline effaced. It is hardly too much to say that the two years' additional training the German child receives in the elementary school, doubles its chance in life as compared with the English child.

But this is not all. The Germans are rapidly developing a system of evening continuation classes which carry on education for two or three years longer. In Saxony the boys who leave the primary school, if they do not go to the higher schools must attend for three years longer—say, until they are seventeen—continuation classes for at least five hours per week. But teaching is provided for them, and they are encouraged to attend, twelve hours per week. So complete is this system that even the waiters at the hotels up to the age of seventeen attend afternoon classes, and are taught one or two foreign languages. I take Saxony as one of the most advanced States; but the law is much the same in Würtemburg and Baden, and the system is found to work so well that it is in contemplation to extend it to all the States in the German Empire, and Austria will probably follow suit. This is confidently expected to happen in the course of 1888. I may state as an undoubted fact that in Germany and Switzerland, and I believe in some other Continental countries, the opinion is ripening into a conviction that the education, even of the poorest class, should be continued in some form or another to the age of sixteen or seventeen. They find by experience that wherever this is adopted it gives an enormous advantage to the people in the competition of life, and, above all, trains them to habits of industry and mental application. I believe it is owing to this system of thorough education that Germany has almost extinguished the pauper and semi-pauper class, which is the bane and disgrace of our country.

Wherever I have gone I have inquired how they deal with the ragged and squalid class of children, and I have been told in every city I visited—in Zurich, Stuttgart, Nuremberg, Chemnitz, Dresden, and Berlin—that such a class practically does not exist. I do not mean that there is not poverty and plenty of it in Germany. Wages are much lower than in England, and many have a hard struggle to live. But there does not seem to exist to any extent that mass of sunken, degraded beings who with us cast their children upon the streets, or throw them on the rates, or leave them to charity. Some half-a-million of children in the United Kingdom are dependent, more or less, on the alms or the rates of the community, and probably another half-million are miserably under-fed and under-clad. Nothing to correspond with this exists in Germany. The poorest people here would be ashamed to treat their children as multitudes do with us. Indeed, I have not seen since I left home a single case of a ragged or begging child. I repeat that the great cause of this both in Germany and Switzerland is the far greater care they have taken of the education of the children for at least two or three generations, whereas we have only taken the matter up seriously since 1870, when Mr. Forster's great Act was passed.

Let us contrast the general condition of our London children, for instance, at the age of fifteen or sixteen, with that of the same class in Berlin or Dresden or Chemnitz. With us nine-tenths of the children have long since left school, and a too large proportion of them are receiving no training but the coarse and brutalizing education of the streets. Most of them retain little of what they have learnt at school, except the power to read the "penny dreadful," which stuffs their minds with everything a child should not know. They are to a very large extent adepts in profane and obscene language, and are frequenters of the public-house, the "penny gaff," and such like amusements; a great many of them are learning no useful trade or calling, but are drifting helplessly into the class of wretched, ill-paid, casual labourers. Very many of them marry before they are twenty, and are soon the parents of a numerous progeny, half-starved and stunted both in body and mind. Compare, or rather contrast, this with Germany. At fifteeen or sixteen a great part of the children are still under excellent instruction. Exceedingly few are to be found roaming about the streets. They are prohibited, at least in some parts of Germany, from entering the public-houses (except with their parents) until the age of seventeen, and I am told are everywhere prohibited from smoking until sixteen. In fact, there are, both by law and public sentiment, barriers placed against the corruption of the young which do not exist in England.

No country has ever suffered more from the abuse of the idea of individual liberty than England has done. Owing to this overstrained idea we did not get compulsory education until long after the advanced nations of the Continent, and still we are far behind them in the care we take of our children. It is intolerable that this state of things should continue longer. Democratic government everywhere insists upon good education, and expects each citizen to fulfil his duties to the State.

Public opinion in our country will certainly insist, and that before long, that we shall not be for ever disgraced with a residuum of the most drunken, demoralized, and utterly incapable population to be found in any modern State. It will insist that some time be spared for the solution of this vital question from the wrangles of party politics and the party recriminations of party leaders. When one sees what a poor country like Germany has done to raise its people in spite of the conscription and three years' compulsory military service, in spite of frequent and exhausting wars from which our island home has been free, one has grave doubts whether our system of party government is not a failure.

Certainly we waste on barren conflicts and wordy strife far more time than other nations do in the conduct of their affairs. They direct their energies with business-like precision to supply the exact needs of the people, we fritter away our enormous political energy in fruitless party contests which every year degrade Parliament lower and lower, and make it less and less fit for the practical work of governing the nation.

One thing seems certain. Unless we can give more attention to the vital questions which concern the welfare of the masses our country must go down in the scale of nations. No honest observer can doubt that in many respects the Germans are already ahead of us, and they are making far more rapid progress than we are. They are applying technical science to every department of industry in a way that Englishmen have little idea of. Their polytechnics and their practical technical schools are far ahead of anything we possess in England, the leaders of industry are far better trained, the workmen are better educated and far more temperate and thrifty than ours are. Wherever the Germans and English are coming into competition upon equal terms the Germans are beating us. This is not because the Germans have greater natural power. I believe the British race is the more vigorous naturally. But they are organized, disciplined, and trained far better than we are. They bring science to bear upon every department of the national life, whereas we, up till lately, resented all State interference, and so exaggerated the doctrines of freedom as almost to glory in our abuses.

There is much more that I might say if space permitted; but it will not do to trespass further on your indulgence. I will only add in conclusion that England must wake up, and that immediately, to the necessity of a far more thorough and practical system of education, else she will lose the great place she has hitherto held in the world's history.

I am, Sir, yours faithfully,

Berlin, October 4. SAMUEL SMITH.

THE BRITISH ASSOCIATION.

SECTION B—CHEMICAL SCIENCE.

The Atomic Weight of Gold, by J. W. Mallet, F.R.S.—Attention is called to the importance of correct determinations of atomic weights by different experimenters, and especially the elimination of "constant errors." Considering the desirability that all such values should be connected as directly as possible with hydrogen, a method is described by which this may be done in the case of gold. A known weight of zinc is dissolved in dilute sulphuric acid, and the hydrogen evolved is measured. A solution of bromide or chloride of gold is then treated with zinc more than sufficient to precipitate the whole of the gold, the residual zinc being determined by the hydrogen evolved on treatment with sulphuric acid. The difference in volume of hydrogen obtained gives a direct means of calculating the atomic weight of gold. The author described various experimental precautions that had been taken in measuring the gas.

The Atomic Weight of Zirconium, by Dr. G. H. Bailey.—The previous determinations of the atomic weight of this element were made by Berzelius (89·25), Hermann (88·8), Marignac (90·54). The earlier results were doubtless vitiated by the presence of iron and of the cerite earths, whilst Marignac's determination is open to objection from the character of the salt (potassium zirconium fluoride) which he used. In the present determination zirconia was prepared from North Carolina zircons by three independent methods. It was dissolved in sulphuric acid, and the sulphate was crystallized out. This salt becomes normal and constant in weight by heating some hours at 400°, the temperature at which it begins to decompose being 470°. The relation of zirconium sulphate to zirconia gives a ratio from which the atomic weight is calculated, and, though the work is not complete enough to state the result with accuracy, the value obtained agrees more nearly with that of Marignac. The author proposes to make further determinations, using the tetrabromide.

Torsion Balances, by Dr. A. Springer.—Light frames are made and stiffened by wires or flat bands being tensioned over them. The beam is then firmly clamped to the bands in such a manner that its centre of gravity is above its point of support; this tends to tip the beam, thus equilibrating the torsional resistance of the fulcrums. We thus have the torsional resistance exerted to keep the beam horizontal, and the high centre of gravity tends to tip it out of the horizontal. The adjustment of the position of the centre of gravity is most easily made by having an adjustable poise placed immediately above the centre of the torsional wire. In order to do away with the necessity of alignment of support, a secondary beam is attached to the first in such a manner that both beams tending to tip in the same direction remain stationary owing to their having opposite and equal moments. On this principle scales are constructed which can be used on rolling ships, or in buildings where there is considerable jarring. In all the "torsion balances" there is permanence of adjustment, consequently repeated weighings will give like results. Various "torsion balances" were shown illustrating the principle involved, as well as to show how equal sensitiveness can be obtained with any load.

Integral Weights in Chemistry, by T. Sterry Hunt.—The author maintains the necessity for taking hydrogen as standard of specific gravity, not only for gases, but also for liquids and solids, and thinks that such considerations lead to a comprehension of the physical properties and chemical constitution of chemical substances.

Action of Light on the Hydracids of the Halogens in presence of Oxygen, by Dr. A. Richardson.—HCl and O were mixed in different proportions in bulbs, and exposed forty to sixty days in sunlight, at the end of which time their contents were examined. Free Cl was only noticeable when large excess of O was present, and when the gases had not been dried. Similar experiments were made in the cases of HBr and HI.

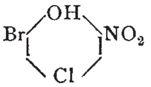
The Present Position of the Alkali Trade, by A. E. Fletcher.—The author, in presenting this report, remarked that no report on this subject had been presented to the Association since that of his predecessor in office Dr. Angus Smith, in 1861. Tracing the general history of the alkali manufacture, he noticed the various improvements which have been carried out in the mechanical details and in the chemistry of the processes, with special reference to the recovery of by-products. The rapid growth of the alkali trade in Germany was shown by a reference to the exports and imports of the product. In Germany this advance is largely due to the adoption of the ammonia-soda process, a process which in this country has been taken up thus far by only three firms. It was pointed out, however, that the Leblanc process, with certain modifications, was not by any means a forlorn hope; and the improvements now being worked out by Messrs. Chance, Messrs. Parnell, and Messrs. Gaskell, Deacon, and Hurter were referred to.

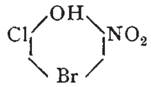
On the Constituents of the Light Oils of Blast-Furnace Coal Tar from the Garthsherrie Works, by Watson Smith.—These tars are recovered from the condensation of the gases evolved from a blast-furnace, condensed by means of the process of Messrs. Alexander and McCosh. The various constituents are described, amongst others toluene and xylene, the latter consisting of about 70 per cent. metaxylene. Considerable interest was manifested in a specimen of flannel dyed by xylidine scarlet prepared from this metaxylene, being the first dye product ever prepared from the by-products of the blast-furnace.

A New Apparatus for condensing Gases by contact with Liquids, by Prof. Lunge.—The apparatus described is of a construction of the "plate column" style, and consists, as the name implies, of a series of perforated plates arranged in column, and made of stoneware. The gases as they rise are thus brought into immediate contact with an extensive plane surface of the absorbing liquid. The cooling is not so rapid as with coke towers and similar arrangements, but it is to be borne in mind that the gases pass more slowly owing to the completeness of the contact with liquid. Comparative results were given showing the working relation between this apparatus and others.

The Extent to which Calico Printing and the Tinctorial Arts have been affected by the Introduction of Modern Colours, by Charles O'Neill.—The author reviewed the state of things in 1856, at which time Perkin's aniline mauve was discovered, and showed the effect of the introduction of alizarine colours. It was shown that the demand had not kept pace with the production, and this had much to do with the unremunerative condition of calico printing.

The Chemistry of Cotton Fibre, by F. H. Bowman.—It is shown that cotton, in common with all vegetable substances, has for its base cellulose. The opinion is here expressed that, judging from the results of combustion, it consists of a series of bodies not agreeing in all respects with one another. The mineral matter of cotton amounts to about 1 per cent., and this is considered to form an essential constituent.

Isomeric Change in the Phenol Series, by O. R. Ling.—The isomers 

and 

were stated to have been prepared. The melting-point of the former was found to be 125°, and its calcium salt contained 2½ molecules of water, whereas the melting-point of the latter was 117°, and its calcium salt contained 7 molecules of water.

On Methylene Blue and Methylene Red, by Prof. Bernthsen.—In this paper it was shown how from thiodiphenylamine, by respective nitration, reduction, and oxidation, Lauth's violet (thionine) was obtained. Methylene blue was described as tetramethylthioninechloride.

On the Constitution of Azimido Compounds, by Drs. Noelting and Abt.—The formulæ given by Griess and by Kekulé for the azimido compounds were explained and discussed, and it was shown that the evidence was in favour of the formula of Kekulé.

Velocity of Formation of Acetic Ether by Prof. Menschutkin.—In these experiments acetic anhydride was used instead of the acid by which in his previous work the process of etherification had been effected. It was found that the velocity of the reaction was greater with the primary than with the secondary alcohols, and that it was much slower in the higher members of an homologous series than in the lower. A distinct and marked difference occurs between isomers as shown by the examination of butyl and isobutyl alcohols. By working in solution the reaction proceeds more regularly, and the results agree better amongst themselves. The author finds that the nature of the solvent affects the course of the reaction in such a manner as to throw some doubts on the hypothesis of Guldberg and Waage.

The Relation of Geometrical Structures to Chemical Properties, by Prof. Wislicenus.—This memoir—probably the most important contribution that has yet been made to the question of the constitution of unsaturated organic compounds—cannot readily be understood without the accompanying diagrams. The results have already been published in the Transactions of the Royal Saxon Academy.

Note on Valency, by Prof. Armstrong.—An attempt to explain the phenomena of valency according to the views expressed by Helmholtz as to the unit charge of the elements and its distribution.

The Solubility of Isomeric Organic Compounds, by Prof. Carnelley.

(1) For any series of isomeric organic compounds the order of solubility is the same as the order of fusibility, *i.e.* the most fusible compound is also the most soluble. This is shown to hold true in a very large number of cases, whilst there are very few exceptions, and those of a doubtful character.

(2) The order of solubility of two or more isomeric compounds is independent of the nature of the solvent. This has been experimentally proved, more particularly in the case of meta- and para-nitraniline, the solubility of each of which in thirteen different solvents has been determined. Also by a considerable number of cases taken from literature.

(3) The ratio of the solubilities of two isomers in a given solvent is constant, and is therefore independent of the nature of the solvent. So that—

$$\frac{\text{Solubility of A in any solvent}}{\text{Solubility of B in the same solvent}} = \text{constant.}$$

This has been proved for meta- and para-nitraniline in respect of thirteen different and very varied solvents.

Alcohol and Water Combinations, by Prof. Mendeléef.—The author looks upon solution as implying a definite chemical combination liable to alteration and to decomposition at ordinary temperatures. He has also examined the phenomena at low temperatures where cryohydrates are formed, and finds the same agreement with his adopted formula. At low temperatures he has obtained solid compounds of alcohol and water containing 17·56, 46·04, and 88·46 per cent. of alcohol respectively. The investigations have been extended to various mineral acids and salts without discovering any exception to the generalized expression given by him.

On the Constitution of Atropine, by Prof. Ladenburg.—This body is shown to belong to the class of bodies known as alkines. The reactions of tropine and its transformations show that it stands in a direct and simple relation to atropine. It has not yet been possible, however, to synthesize tropine.

The Reduction-products of the Nitro-paraffins and Alkyl Nitrites, by Prof. Dunstan and T. S. Dymond.—The authors have studied the reduction of ethyl nitrite, using ferrous hydroxide as the reducing agent. More than two-thirds of the nitrogen of the ethyl nitrite is liberated in the form of gas, either nitrous oxide or nitrogen; the remainder appears partly as ammonia and partly as ethylamine. If potassium hydroxide is mixed with the ferrous compound a considerable quantity of potassium hyponitrite is formed. It is also probable that ethyl hyponitrite, a compound that has not yet been prepared, may also be formed as an intermediate compound. The authors are further investigating the change with the object of isolating this compound and of discovering the mode of formation of the ethylamine. The reducing action of ferrous hydroxide on the nitro-paraffins was also partially investigated with interesting results.

On a Partial Separation of the Constituents of a Solution during Expansion by Rise of Temperature, by J. W. Mallet, F.R.S.—When solutions of colloid substances—some alcoholic, some aqueous—are exposed to cold, and afterwards to a gradually increasing temperature, the expansion in the liquid has been noticed to take place with a partial or entire separation of the substance dissolved in the upper layer, without any deposition of solid matter.

A New Method for Determining Micro-Organisms in Air, by Prof. Carnelley and Thos. Wilson, University College, Dundee.—This is a modification of Hesse's well-known process. It consists essentially in the substitution of a flat-bottomed conical flask for a Hesse's tube. Its chief advantages are: (1) much smaller cost of flask and fittings as compared with Hesse's tubes; (2) very much fewer breakages during sterilization; (3) great economy in jelly; (4) freedom from leakage during sterilization; (5) results not vitiated by aërial currents.

The Absorption-Spectra of Rare Earths, by Dr. G. H. Bailey.—This paper is an examination of the conditions of observation of absorption-spectra with a special view to the recent announcement of the twenty new elements of Krüss and Nilson. The author finds that the strengths of the absorption bands do not diminish equally in all parts of the spectrum when the liquid is diluted. The presence of nitric acid also effects not only a displacement of the bands, but also an alteration in their relative intensity. It is further pointed out that a record of the strength of the bands in mixtures containing, in some cases, large quantities of samaria and erbia, and in others none, cannot be used as a means of comparison, and deductions drawn from variations of intensity are untrustworthy. Whilst acknowledging that, with due allowance for such factors, some assistance may be gained towards the course of fractionation, the author considers the announcement of new elements quite premature, and only calculated to throw further confusion into this already difficult field of work.

The Absorption-Spectra of the Haloid Salts of Didymium, by Dr. G. H. Bailey.—Bunsen has described certain variations that occur in the absorption-spectra given by crystals of the didymium salts. In this paper are detailed the variations produced in the absorption-spectra of crystalline salts of didymium when examined in polarized light. A comparison of the chloride, bromide, and iodide of didymium has also been made, from which it appears that in the bromide the bands are situated 5λ further towards the red end of the spectrum than in the chloride, whilst the displacement for the iodide is 14λ towards the violet. In the solution of the chloride (or nitrate) the bands have almost the same position as in the crystals of the iodide, whilst the addition of nitric acid causes a displacement of 12λ towards the red. It is proposed to determine how far this displacement of bands is due to the dispersion equivalent of the menstruum, and whether it gives evidence of dissociation in the liquid.

On Solution, by W. Durham.—The theory of solution adopted by the author of this paper was published by him before the Royal Society of Edinburgh in 1878. According to these views solution is due to the chemical affinity of the elements of the substance dissolved for the elements of the solvent.

Thermal Phenomena of Neutralization, and their bearing on the Nature of Solution, by W. W. J. Nicol.—A consideration of the general relationship existing between the heats of formation of various salts in dilute aqueous solutions.

Notes on some peculiar Voltaic Combinations, by C. R. A. Wright, F.R.S., and C. Thompson.—The combinations consist of a class of cells in which one or both of the "plates" is a film of gas condensed on the surface of an electrically conducting solid, which is itself not appreciably acted on. In Grove's gas battery both plates are gas films. Mercury and silver in dilute sulphuric acid opposed to aëration plates of platinum sponge form sulphates, whilst gold dissolves in potassium cyanide under the same conditions. If an acid and alkaline solution be united by means of a wick a considerable current is producible for a short time in the external circuit, but this falls off rapidly in consequence of the development of free hydrogen on the surface of the plate in the acid fluid and of oxygen on the other plate. No direct quantitative proof of this has, however, been given, and there are given in this paper a number of experiments showing that for every milligramme equivalent of silver deposited 11·2 cc. of hydrogen are evolved.

The Present Aspect of the Question of the Sources of Nitrogen in Vegetation, by Sir J. Lawes, F.R.S., and Dr. Gilbert, F.R.S.—An outline of the work of various experimenters in this line of research was given, indicating that, whereas in accordance with the original observations of Boussingault the authors had found that nitrogen was assimilated in part from the atmosphere directly, the results of Berthelot, Frank, and others derived all nitrogen from the soil. These results were criticised, and it was pointed out that the methods pursued failed in that they did not represent normal conditions of growth of vegetation.

Dispersion Equivalents and Constitutional Formulæ, by Dr. J. H. Gladstone.—The difference between the refraction equivalent, as observed for the line "A" and for the line "H" in the spectrum, is called the dispersion equivalent. The refraction equivalent of a compound is in general the sum of the refraction equivalents of the elements of which it is composed, but varies according to the constitution. The same holds for the dispersion equivalent, and it is shown that in some cases differences are observable in this respect where they are not indicated by constitutional formulæ, as, for instance, in the allyl compounds, and in naphthalene derivatives.

On Organic Vanadates, by J. A. Hall.—A series of organic vanadates are described, which can be distilled under reduced pressure without decomposition. They are obtained by the action of an alkyl bromide on silver orthovanadate.

On some New Cinnamic Acids, by Dr. Cohen and Prof Perkin.—A description of a method of obtaining certain substituted cinnamic acids from aromatic aldehydes in cases where, from the nature of the aldehyde, Perkin's reaction cannot be employed. The aldehydo-salicylic acids are converted into ethereal salts, and these are heated with sodium alcoholate, and finally with sodium acetate and acetic anhydride.

The Antiseptic Properties of Metallic Salts, by Prof. Carnelley. This paper consisted of a description of experiments performed by the author illustrative of further relations between the chemical composition of a substance and its antiseptic properties.

Antiseptic Properties of some Fluorine Compounds, by W. Thomson.—The author describes in this paper the antiseptic properties of sodium fluosilicate. The body is not poisonous, and possesses no smell. Its superiority over chloride of mercury for surgical purposes is claimed.

On the Composition of Water by Volume, by A. Scott.—From various preliminary experiments the author was led to conclude that the relation of oxygen to hydrogen in water was not accurately represented by the numbers 1 : 2. Subsequent experiments gave the ratio 1 : 1·997 with small variation.

On some Vapour Densities at High Temperature, by A. Scott.—A number of vapour densities of inorganic salts of certain elements have been determined by means of the well-known method of Victor Meyer, at a temperature above the melting-point of cast iron. A breaking up of the molecule is shown to occur in the case of iodine, cadmium iodide, mercuric sulphide, mercurous chloride, and mercuric chloride.

On the Estimation of the Halogens and Sulphur in Organic Compounds, by R. T. Plimpton.—The method suggested as a substitute for those already in use is that of introducing the substance into the flame of a Bunsen burner, or into a jet of hydrogen, the products of the combustion being aspirated through an absorbent liquid. In this solution the amount of the halogens or of sulphur can afterwards be estimated.

On the Derivatives and Constitution of the Pyrocresols, by W. Bott and Prof. Schwarz.—The authors describe some derivatives of these bodies, and are led to conclude that the α-pyrocresol and its isomers are anhydrides similar in constitution to diphenyl ether.

SECTION C—GEOLOGY.

On the Mineralogical Constitution of Calcareous Organisms, by Vaughan Cornish and Percy F. Kendall.—In Dr. Sorby's presidential address to the Geological Society in 1879 it was stated that both calcite and aragonite occur in organic structures, and that aragonite fossils are less stable than those of calcite. It appeared probable that carbonic acid has been the agent which effected the removal of the aragonite, but there are no published experimental data to show that it would remove aragonite more readily than calcite. The authors gave an account of the experimental evidence obtained as to the cause of the inferior stability of aragonite fossils as compared with those formed of calcite, with observations on the geological conditions favourable to the removal of aragonite fossils. They then described the work done in following out these observations, and in the examination of certain organisms belonging to groups not yet classified according to their mineralogical constitution.

The Matrix of the Diamond, by Prof. H. Carvill Lewis.—A microscopical study of the remarkable porphyritic peridotite which contains the diamonds in South Africa demonstrates several interesting and peculiar features which are described in detail. It is one of the most basic rocks known, and has a composition which by calculation would belong to a rock composed of equal parts of olivine and serpentine, impregnated by calcite. It is a volcanic breccia, but not an ash or tuff, the peculiar structure being apparently due to successive paroxysmal eruptions. A similar structure is known in *meteorites*, with which bodies this rock has several analogies. The microscopical examination supports the geological data in testifying to the igneous and eruptive character of the peridotite, which lies in the neck or vent of an old volcano. While belonging to the family of peridotites, this rock is quite distinct in structure and composition from any member of that group heretofore named. It is more basic than the picrite porphyrites, and is not holocrystalline like dunite or saxonite. It is clearly a new rock-type, worthy of a distinctive name. The name *Kimberlite*, from the famous locality where it was first observed, is therefore proposed. Kimberlite probably occurs in several places in Europe, certain garnetiferous serpentines belonging here. It is already known at two places in the United States: at Elliott County, Kentucky, and at Syracuse, New York; at both of which places it is eruptive and post-Carboniferous, similar in structure and composition to the Kimberley rock. At the diamond localities in other parts of the world diamonds are found either in diluvial gravels or in conglomerates of secondary origin, and the original matrix is difficult to discover. Thus, in India and Brazil the diamonds lie in a conglomerate with other pebbles, and their matrix has not been discovered. Recent observations in Brazil have proved that it is a mistake to suppose that diamonds occur in itacolumite, specimens supposed to show this association being artificially manufactured. But at other diamond localities, where the geology of the region is better known than in India or Brazil, the matrix of the diamond may be inferred with some degree of certainty. Thus, in Borneo, diamonds and platinum occur only in those rivers which drain a serpentine district, and in Timor Laut they also lie in serpentine. In New South Wales, near each locality where diamonds occur, serpentine also occurs, and is sometimes in contact with carboniferous shales. Platinum, also derived from eruptive serpentine, occurs here with the diamonds. In the Urals, diamonds have been reported from four widely separated localities, and at each of these, as shown on Murchison's map, serpentine occurs. At one of the localities the serpentine has been shown to be an altered peridotite. A diamond has been found in Bohemia in a sand containing pyropes, and these pyropes are now known to have been derived from a serpentine altered from a peridotite. In North Carolina a number of diamonds and some platinum have been found in river sands, and that State is distinguished from all others in Eastern America by its great beds of peridotite and its abundant serpentine. Finally, in Northern California, where diamonds occur plentifully and are associated with platinum, there are great outbursts of post-Carboniferous eruptive serpentine, the serpentine being more abundant than elsewhere in North America. At all the localities mentioned chromic and titanic iron-ore occur in the diamond-bearing sand, and both of these minerals are characteristic constituents of serpentine. All the facts thus far collected indicate *serpentine*, in the form of a decomposed eruptive peridotite, as the original matrix of the diamond.

On the Discovery of Carboniferous Fossils in a Conglomerate at Moughton Fell, near Settle, Yorkshire, by Robert Law and James Horsfall.—After briefly noting the various exposures of the conglomerate, its unconformability with the Silurian rocks, its nature, probable age, and the circumstances which led to the discovery of fossils in it; the authors described the following section exhibited on the south-west side of the Moughton Fell.

	Feet.
a. Scar limestone, of light grey colour and well jointed; layers very distinct in lower parts and almost horizontal, the genus *Bellerophon* being the commonest fossil in the lowest bed of this rock	300 to 500
b. CONGLOMERATE.—Of a bluish-grey colour when newly fractured, and becoming reddish on exposure to the air. The fragments consist of slate, grit, flagstone, and vein-quartz, all apparently derived from Silurian rocks. Fossil shells and corals are common throughout the bed. *Bellerophon*, *Euomphalus*, *Syringopora*, and *Lithostrotion* are the prevailing genera...	1 to 12
c. Lower Silurian slates, of great thickness, having a north-east strike, and a dip of about 65°. The dip and cleavage appear to be on the same plane in this locality.	

The nature and the origin of the stones in the conglomerate were next pointed out; also it was shown that the portion of the bed in which fossils had been found was not more than 200 yards in length, and that it was thickest in the middle, thinning out to the east and west, and at one point could be seen merging into the overlying limestone. Twenty species of fossils were collected from the conglomerate.

Places of Geological Interest on the Banks of the Saskatchewan by Prof. J. Hoyes Panton.—The writer, after referring to some of the marked geological features which characterize the three great prairie steppes of the North-west of Canada, proceeds to describe two localities more particularly, viz. the vicinity of Medicine Hat, situated on the banks of the Saskatchewan, 660 miles west of Winnipeg, and a locality near Irvine Station, 20 miles east of Medicine Hat.

The History and Cause of the Subsidences at Northwich and its Neighbourhood, in the Salt District of Cheshire, by Thos. Ward.—The frequent occurrence of subsidences in the neighbourhood of Northwich makes it desirable to learn their history and cause. Northwich overlies extensive beds of salt. These occupy about three square miles. The first, or "top" rock-salt, lies at a depth of about 50 yards from the surface, and is covered by Keuper marls, and these by the drift-sands and marls. Between the two beds of salt there are 30 feet of indurated Keuper marl. The second, or "bottom" rock-salt, is over 30 yards in thickness. The subsidences which are so destructive in the town of Northwich and the neighbourhood are entirely caused by the pumping of brine for the manufacture of white salt. It was only about 1770, or shortly afterwards, that the first sinking was noticed; since that date, subsidence has gone on very rapidly, and much destruction of property has resulted. Large lakes or "flashes," one of more than 100 acres in area, and of all depths up to 45 feet, have been and are being formed. This peculiar phenomenon of subsidence in the salt-districts is worthy of more consideration than it has hitherto received from scientific men.

The Sonora Earthquake of May 3, 1887, by Dr. T. Sterry Hunt, F.R.S., and James Douglas.—On the afternoon of May 3, 1887, at 2.12 Pacific time (= 120° W. of Greenwich), the first of a series of earthquake movements was felt in the State of Sonora and the adjacent parts of Mexico and the United States, over an area extending from El Paso in Texas on the east to the River Colorado and the Gulf of California on the west, and from the State of Sinoloa on the south as far north as Albuquerque in New Mexico; the extremes in both directions being over 500 miles. It was the fortune of the writers to be at the time at the great copper-mining camp of Bisbee in Arizona, in a narrow gorge of the Mule Pass Mountains, about 5300 feet above the sea, and near the border of Sonora. A violent tremor of the earth, including two sharp shocks, and lasting over ninety seconds, was succeeded at frequent intervals by many minor movements in the next three days, and, less frequently, at least up to May 29. In this part of Arizona solid house-walls, of *adobe* or unburned brick, were cracked or overturned, while huge rocks in the steep mountain gorges rolled down, causing much damage. Fires, perhaps kindled by these in their course, appeared immediately afterwards in various wooded regions in Sonora and Arizona, giving rise to many false rumours of volcanic eruptions. The movement here seemed from south to north. The small town of Bavispe in the Sierra Madre in Sonora was nearly destroyed, many people being wounded and forty-two killed. Opoto suffered in a similar way, and Fronteras to a less extent. The district chiefly affected by the earthquake is, however, for the most part a desert, with some cattle ranches and mining stations. Interesting studies were made by the authors in the valleys, or *mesas*, between the parallel mountain ridges in this region, both in the San Pedro and Sulphur Spring Valleys. The latter, to the east of Bisbee, and stretching north and south about 100 miles, is often 8 or 10 miles wide, and has its lower portion in Sonora. Though without a visible watercourse, water is there generally found at depths of from 10 to 40 feet in the numerous wells sunk at intervals to supply the needs of large herds of cattle. As described by many observers, the surface of this plain was visibly agitated by the first earthquake shock, so that persons were in some places thrown down by the heaving of the soil, which burst open with discharges of water, while the wells overflowed and were partially filled with sand. In the southern part of this valley, for about 7 miles south from the Mexican frontier, the authors found the results of the undulatory movement of the soil apparent in great numbers of cracks and dislocations. For distances of several hundred feet, along some lines with a generally north and south course, vertical downthrows on one side of from 1 foot to 2 feet and more were seen, the depressed portion rising either gradually or by a vertical step to the original level. Branching, and in some cases intersecting, cracks were observed. These depressions were evidently connected with outbursts of sand and water, which, along cracks, marked by depressions on both sides, sometimes covered areas of many hundred square feet with layers a foot or more in depth, marked here and there by craters 2 feet or more in diameter, through which water had risen during the outburst of these mud volcanoes. While the earthquake movements in the adjacent hills of Palæozoic strata had left no marks, the dislocations over many square miles in the valley would have sufficed to throw down buildings and to cause great loss of life in an inhabited region. There are believed to be no evidences of previous earthquake disturbances in this region since its discovery by the Spaniards centuries ago. From the published reports of commissioners named by the State of Sonora, it appears that the regions injured by the earthquake are in two nearly parallel north and south valleys in the district of Moctezuma, along the River Bavispe, a tributary of the Yaqui. In both regions are noticed the opening, in the arable lands, of numerous fissures, generally north or north-east in direction, from many of which water flowed abundantly. The river thus supplied in a time of excessive drought swelled to the volume usual in the rainy season of summer, a condition which lasted up to the time of the report of Señor Liborio Vasquez, dated at Bavispe, May 29, 1887. The fields had become green and the air moist with prevailing fogs. A report concerning the region of Opoto mentions not less than seven volcanoes in the vicinity, which were seen burning for two days, but without any flow of lava; while that for the Bavispe region declares that no volcano had there been discovered. The authors incline to the belief that, as was the case in the San José Mountains, and others examined by them along the borders of Arizona, the appearances of volcanoes near Opoto were due to forest fires.

The Disaster at Zug on July 5, 1887, by the Rev. E. Hill.—On July 5, 1887, at the town of Zug, in Switzerland, a portion of the shore gave way and sank into the lake. About three hours later another much larger adjacent area also suddenly subsided, so that in all an area considerably over two acres, with half of one of the principal streets, was submerged to a depth of about 20 feet. It can be seen that the subsoil consists of coarse gravel and sand, followed after a few feet by soft wet sand and fine mud. According to Prof. Heim, this fine mud or sludge reaches to a depth of nearly 200 feet, and the disaster is shown to be due to a flowing out into the lake of this mobile sludge from under the superincumbent weight of buildings and firmer ground. The buildings collapsed as they sank. The catastrophe must have been long impending; the exact cause which precipitated it is indeterminate, but a low level of the lake and tremors from pile-driving for new quays are suggested as contributories. On the English coast the incessant changes of pressure from tides probably render impossible such instability of equilibrium.

The Triassic Rocks of West Somerset, by W. A. E. Ussher.—This paper is the result of investigations made in the years 1878 and 1879. The constitution, extent, and general relations of the Lower, Middle, and Upper Triassic rocks of the area are briefly described, with the following general results:—The Lower Trias consists of breccia and breccio-conglomerate upon sands and brecciated sand and loam; it is faulted against Keuper basement beds, and is conformably overlapped by Middle Trias marls upon the margin of the older rocks. The Middle Trias consists of marls with sandstones in places at their base; it is faulted against the successive divisions of the Keuper on the east, and terminates northward in the angle made by converging faults at Bicknoller. The Middle Trias marls rest on the older rocks near Vellow Wood Farm, and finally disappear near Orchard Wyndham, south of Williton, under Keuper breccias. The Keuper beds consist of marls, sandstones, and a locally varying series of conglomerates, gravels, and breccia in descending sequence. The sandstones are very calcareous south of Crowcombe; they form marginal deposits in places near Dunster. The coarser beds of the Keuper develop at the expense of the sandstones in the area west of Williton. It is very probable that the Keuper basement beds of the Porlock valley may be marginal deposits formed during a progressive subsidence, and therefore may belong to a higher horizon than the Lower Keuper beds south of Williton.

The Devonian Rocks of West Somerset on the Borders of the Trias, by W. A. E. Ussher.—The composition of the Quantocks is first briefly described, and the faulted relations of Middle Devonian grits, slates, and limestones of which they consist alluded to. From the constitution of the Palæozoic districts on the east and west of the Triassic rocks of Crowcombe and Stogumber, the author considered the beds eroded in the intervening valley would amply account for the variability of the Triassic strata derived from them. From Withycombe to Porlock the faulted relations of the Middle and Lower Devonian grits are then briefly described. The author considered that the elevation of the Quantocks, the Brendon, and the Dunkery ranges was pr

Triassic, accompanied by faulting on an extensive scale; that many lesser faults were produced in post-Triassic times, and that further movements took place along the old lines of fracture. He did not believe that the Devonian highlands were ever covered by Secondary sediments, but was of opinion that the Triassic rocks never extended far beyond their present boundaries, except in old valleys from which they had subsequently been almost entirely removed by denuding agencies.

Observations on the Rounding of Pebbles by Alpine Rivers, with a Note on their Bearing upon the Origin of Bunter Conglomerate, by Prof. T. G. Bonney, F.R.S.—The author describes the result of his observations of the rounding of pebbles in various torrents and rivers in the Tyrol and Dauphiné, and of the gravels of the Piedmontese and Lombard plains. These lead to the following conclusions, among others: (*a*) that pebbles are rounded with comparative rapidity when the descent of the stream is rapid, and they are dashed down rocky slopes by a roaring torrent capable of sweeping along blocks of much greater volume; (*b*) that pebbles are rounded with comparative slowness when the descent is gentle and the average pace of the river is about adequate to push them along its bed. The rocks observed were in some cases limestone and not very hard grits; in others various crystalline rocks, such as granite, gneiss, or mica-schist. Hence, as the majority of the pebbles in the Bunter are of harder material, and are generally better rounded than those which the author observed, he concludes that it is impossible to suppose them mainly derived from any tract of land which, in Triassic times, can have existed in either Central or Eastern England, for they must have been formed by rivers no less important, with courses either longer or steeper than those of Central Europe. Thus these observations are very favourable to the view which ascribes to them a Scotch origin, where alone rocks exactly like them are known to occur.

The Terminal Moraines of the Great Glaciers of England, by Prof. H. Carvill Lewis.—The investigation here recorded is based upon the important principle that *every glacier at the time of its greatest extension is bounded and limited by a terminal moraine*. The great ice-sheet which once covered Northern England was found to be composed of a number of glaciers, each of which was bounded by its own lateral and terminal moraines. These glaciers were studied in detail, beginning with the east of England; the North Sea glacier, the Wensleydale glacier, the Stainmoor glacier, the Aire glacier, the Irish Sea glacier, and the separate Welsh glaciers were each found to be distinguished by characteristic boulders, and to be defined by well-marked moraines. The terminal moraine of the North Sea glacier, filled with Norwegian boulders, may be seen in Holderness, extending from the mouth of the Humber to Flamborough Head, and consists of a series of conical hills inclosing meres. The Irish Sea glacier, the most important glacier of England, came down from Scotland, and, being reinforced by local ice-streams, and flowing southward until it abutted against the mountains of Wales, it was divided into two tongues, one of which flowed to Wellington and Shrewsbury, while the other went south-west across Anglesey into the Irish Sea. This great glacier and its branches are all outlined by terminal moraines, described in detail. A small tongue from it, the Aire glacier, was forced eastward at Skipton, and has its own distinctive moraine. In the neighbourhood of Manchester the great moraine of this Irish Sea glacier may be followed through Bacup, Hey, Staleybridge, Stockport, and Macclesfield, being as finely developed as the moraines of Switzerland and America. South of Manchester it contains flints and shell-fragments, brought by the glacier from the sea-bottom over which it passed. At Manchester the ice was at least 1400 feet thick, being as thick as the Rhone glacier. The great terminal moraine now described of the united glaciers of England, is a very sinuous line, 550 miles in length, extending from the mouth of the Humber to the farthest extremity of Carnarvonshire, and, except where it separates the Welsh glaciers from the North Sea glacier, it everywhere marks the extreme limit of glaciation in England, and is an important feature which might well hereafter be marked on the geological map of England.

In a separate paper, read at a subsequent meeting, the author described more in detail the moraine near Manchester.

On some Important Extra-Morainic Lakes in Central England, North America, and elsewhere, during the Period of Maximum Glaciation, and on the Origin of Extra-Morainic Boulder-Clay, by Prof. H. Carvill Lewis.—The lakes so characteristic of all glaciated regions are due to several causes. Some few are due to an actual glacier scooping-out of the rock-floor, many to an irregular deposition of the drift by which former watercourses are obstructed, and still others to the terminal moraine or to the glacier itself. These latter, known as *morainic lakes*, may be divided into *inter-morainic lakes*, *moraine meres*, and *extra-morainic lakes*, according to their position—back of, in, or outside of the moraine. Extra-morainic lakes, if dammed up by the ice front, are temporary in character, disappearing with the retreat of the glacier; but, as they may be of enormous extent if the glacier is large, they may produce deposits of much geological importance. Instances of such lakes occur in Switzerland, and ancient examples occur as well in Northern Germany, Asia, North America, and Central England. They are to be expected wherever a glacier advances against or across the drainage of a country. Mr. Belt supposed that Northern Asia was covered by a lake of this character, caused by the Polar glacier obstructing the rivers flowing north. In North America, where the terminal moraine has been accurately mapped for thousands of miles, deposits of boulder-clay and erratics occur outside of the moraine, and have been supposed to be due to an older glacier in the first Glacial epoch. But the entire absence of striæ or of glacial erosion or moraines in this district prove that a glacier was not the agent of deposition. Nor are there any traces of marine life in the deposits. This extra-morainic boulder-clay is narrow in Pennsylvania, where the author had called it "the Fringe," but west of the Missouri it is 70 miles wide; and in British America, between the great moraine called the "Missouri Coteau" and the Rocky Mountains, it is 450 miles wide and over 1000 miles long. It only occurs where rivers had flowed *towards* the glacier, and is explained as the deposit of great temporary fresh-water lakes dammed up by the ice front, the erratics having been dropped by icebergs. Similar deposits occur in England outside of the terminal moraine, and have been the subject of much discussion; being held by some to be a proof of marine submergence, by others to be the ground-moraine of a glacier. The "great chalky boulder-clay" is the best known of these deposits. There are serious objections to the two theories heretofore advanced to explain this, whilst the hypothesis of extra-morainic fresh-water lakes, dammed up by the glaciers, is sustained by all observed facts. The most important of these lakes was one caused by the obstruction of the mouth of the Humber by the North Sea glacier, whose terminal moraine crosses that river at its mouth. This large lake reached up to the 400-feet contour line, and extended southward nearly to London, and westward in finger-like projections into the many valleys of the Pennine Chain. It deposited the "great chalky boulder-clay," and erratics were floated in all directions by icebergs. The conclusion that the glacial phenomena of England are due neither to a universal ice-cap nor to a marine submergence, but to a number of glaciers bordered by temporary fresh-water lakes, is in accordance with all the observations of the author in England and elsewhere.

On the Extension of the Scandinavian Ice to Eastern England in the Glacial Period, by Prof. Otto Torell.—The author described the glacial deposits of Eastern England, particularly those of Holderness and Cromer, the latter having been examined by him on several occasions during the last twenty years. Applying his experience gained during winters spent within the Arctic Circle, the author showed that the boulder-clay of Holderness and Cromer is a true ground moraine formed near the southerly limit of the Scandinavian ice-sheet. The Cromer tills were formed by an extension of the Baltic ice; Swedish boulders brought by this ice can be traced across the German plain, and are found at Cromer. The till of Holderness was formed by an extension of the Skagerack, as is proved by characteristic Norwegian boulders. The Baltic ice retreated first, and the Skagerack ice, still moving onward, ploughed into and contorted the Cromer till. The distribution of the boulder is described in detail, as also is the succession of the beds as worked out by Mr. Clement Reid, whose facts and conclusions fit well with the opinions advanced by the author.

A Comparative Study of the Till or Lower Boulder-Clay in several of the Glaciated Countries of Europe—Britain, Scandinavia, Germany, Switzerland, and the Pyrenees, by Hugh Miller.—The sections of foreign till examined by the author occur chiefly in the neighbourhood of the Trondhjem Fjord in Norway, at Berlin and Leipzig in Germany, near the Lake of Geneva in Switzerland, and in the valleys of the Pyrenees directly south from Pau in Southern France. In these countries and in Britain the till bears an identical character. It is not more variable throughout Europe than the author has found it to be in Scotland and Northern England. On the basement-gneiss at Christiansund, in South-Western Norway, it is the same as on the basement-gneiss of Sutherlandshire; in the great limestone valley of Eaux Chauds, in the Pyrenees, it is scarcely to be distinguished from the till of the limestone valleys of Yorkshire. In all the places mentioned (more doubtfully at Berlin and Leipzig) it bears the unmistakable character of a ground-moraine accreted under the direct weight of glacier-ice; its essential character is that of a rude pavement of glaciated debris ground from the rocks over which the glaciers have passed, with its larger boulders firmly glaciated *in situ* on their upper sides in the direction of ice-movement, and with a tendency to the production of fluxion structure here and there in the matrix, due to the onward drag of the superincumbent ice. In mere indiscriminateness of composition (which is a character much emphasized by glacialists) the till is not to be distinguished from boulder-clays formed under berg- or raft-ice, such as the highest marine clays of the Norwegian coasts, which are stuck promiscuously through with boulders derived from the glaciers of the interior. The glaciation of boulders *in situ* the author finds to be a crucial distinction; he readily detected this "*striated-pavement*" character in the tills of all the districts above mentioned except Leipzig and Berlin, where the boulder clays more resemble the upper boulder-clay (Hessle clay) of the eastern seaboard of England and Scotland, and in the sections examined by him.contained no large blocks.

Note on a few of the many Remarkable Boulder-stones to be found along the Eastern Margin of the Wicklow Mountains, by Prof. Edward Hull, F.R.S.—Amongst the evidences of the former existence of an extensive sheet of ice descending from the Wicklow Mountains towards the shores of the Irish Sea is the occurrence of boulder-stones, chiefly formed of granite or granitoid gneiss, derived from the mountainous range to the westward, of a size seldom equalled—probably not surpassed—amongst the British Isles. (1) The Mottha Stone is perched on the summit of Cronhane Hill, above Castle Howard, and is a conspicuous object for all directions. It consists of grey granite, and rests upon Lower Silurian slate; its weight would be about seventy tons. It lies at a level of 816 feet above the sea, and is about 10 or 12 miles from the flanks of Lugnaquilla, whence, as we may suppose, the granite block started on its journey. (2) In the valley between Castle Kevin and Moneystown, where large boulders are numerous, there lies a block of granite about 100 tons in weight. The birth-place of this boulder was probably the mountainous district about Mullaghcleevann, 2783 feet in height, lying at the head of the valley in which is situated the deep waters of Lough Dan, and it probably travelled a distance of 8 or 9 miles in an east-south-east direction. (3) The last boulder-stone is perhaps the largest in the British Islands. It stands behind a cottage by the roadside, near Roundwood Church, and is quite as large as the cottage itself, to which it forms a good protection from the storms descending from the mountains behind. This boulder consists of granitoid gneiss, resting on Lower Silurian slate and grit, and is about 240 tons in weight. The source of this block, which lies at an elevation of about 800 feet above the sea, was probably in the same locality with that of the Castle Kevin boulder, and the distance travelled was about 6 or 7 miles. The blocks above noticed, with many others of smaller size, do not belong to any of the local glaciers which once filled the valleys towards the close of the Glacial epoch, and which have left numerous well-formed moraines in nearly all the principal valleys descending from the Wicklow range. They are to be referred, in all probability, to the earlier stage of intense glaciation, in which the whole district was covered with perennial snows and ice, moving eastward into the hollow now occupied by the waters of the Irish Sea.

On New Facts relating to Eozoon Canadense, by Sir J. William Dawson, F.R.S.—For several years no new facts respecting the Canadian Eozoon have been published, though there has been some discussion on the subject abroad. In so far as the author is concerned, this has arisen from the circumstance that the late Dr. Carpenter had in preparation an exhaustive memoir, for which Canadian material was being supplied, but which was unfortunately left unfinished at his death. The material collected for this has now been placed at the disposal of Prof. T. Rupert Jones, F.R.S., and in the meantime the present note is intended merely to direct attention to some new facts recently obtained. The form of Eozoon has been definitely ascertained to be normally inverted conical or broadly turbinate, except where several specimens have become confluent, or when rounded masses have been based on some foreign body. The larger specimens are traversed by cylindrical or long conical vertical openings (pores or oscula), around which the laminæ, becoming confluent, form an imperfect wall. Some other points of detail were mentioned, and facts were referred to indicating the continuity and definitely stratified character of the beds in the Middle and Upper Laurentian of Canada. A variety of laminated rocks and minerals which had been mistaken for Eozoon were referred to. Their description in more detail will be found in forthcoming memoirs of the Peter Redpath Museum.

Elements of Primary Geology, by T. Sterry Hunt, F.R.S—The author, after recalling his classification of original or non-clastic rocks into Indigenous, Endogenous, and Exotic masses, based on their geognostic relations, gives in a concise form his theory of the genesis of these various groups of rocks, as taught more at length in his recent volume entitled "Mineral Physiology and Physiography." The superficial portion of a cooling globe, consolidating from the centre from a condition of igneous fusion, he conceives to have been the protoplasmic mineral matter, which, as transformed by the agencies of air, water, and internal heat, presents a history of mineralogical evolution as regular, as constant, and as definite in its results as that seen in the organic kingdoms. This great transformation involves a series of processes, which include: (1) the removal from the protoplasmic mass, through permeating waters, heated from beneath, of the chief elements of the great groups of indigenous crystalline and colloidal rocks, by what he has called the crenitic process; (2) the modification of the residual portion by this lixiviation, which removes silica, alumina, and potash, and, by the intervention of saline waters, brings in additional portions of lime, magnesia, and soda; (3) the partial differentiation, by crystallization and eliquation, of portions of this more or less modified residue, giving rise to the various types of plutonic rocks. The direct and indirect results of subaërial decay through atmospheric agencies, and those of the products of organic life, are also considered. From the operation of all these processes result progresssive changes in the composition alike of plutonic and of indigenous rocks. The endogenous rocks or veinstones are, like the last, of crenitic origin, and may be granitic, quartzose, or calcareous in their characters.

The author next considers the conditions of softening and displacement of indigenous rocks which permit them to assume in many cases the relations of exotic rocks, and to become extruded after the manner of lavas, as seen in the case of trachytes and many granite-like rocks. Such masses he designates pseudoplutonic. With these are often confounded the endogenous granitic veinstones, which were formed under similar chemical conditions to the indigenous granites. Masses alike of indigenous, endogenous, and exotic rocks may also become displaced, not through softening, but by being forced while in a rigid state, through movements in the earth's crust, among masses softer and more yielding than they.

The author also considers the fluxional structure seen in plutonic and pseudoplutonic eruptive masses, which has led some theorists to regard these as of aqueous origin, and others to maintain that the crenitic stratiform masses themselves are of plutonic origin—two opposite errors which vitiate much of our geological literature. The crenitic process, by removing (from beneath what was the original surface of deposition) the vast amount of material which forms alike the indigenous, the endogenous, and the pseudoplutonic rocks, has effected a great diminution in volume in the protoplasmic mass, besides that due in later times to extrusion of plutonic matter itself. This decrease in bulk of the underlying stratum was a potent agent in producing the universal corrugation of the earlier crenitic rocks, and the frequent discordances observed among them.

The author considers further the gradual diminution of the crenitic process seen in the later periods of Archæan time, and its feebler manifestations in Palæozoic and more recent ages down to the present. He notes moreover,that, as the result of geographical changes, erosion and partial deposition alike disturbed the succession of the later groups of crenitic rocks, none of which can claim that universality and uniformity which belong to the oldest known group, the fundamental granitoid gneiss.

The author concludes with a brief sketch of the great divisions of the indigenous crenitic rocks recognized by him, from the most ancient granitic substratum to the Taconian series, which appears to be the last of the characteristically crystalline indigenous groups, it being, so far as known, succeeded directly by the uncrystalline Cambrian, or the equally uncrystalline Keweenian, which may not, improbably, be itself included in the lower part of the Cambrian series.

Gastaldi on Italian Geology and the Crystalline Rocks, by T. Sterry Hunt, F.R.S.—The author recalled the fact that, in discussing in 1883 the geological relations of serpentines, he had maintained that, although not confined to Archæan rocks (in which they are found at various horizons), those of Italy, believed by some geologists to be in part of Tertiary age, are, so far as his studies go, wholly Archæan, in accordance with the views set forth by Gastaldi. The serpentines and other rocks of the ophiolitic group existed in their present condition in the seas in which were deposited the Eocene strata, which latter, by subsequent terrestrial movements, had been disturbed, broken, and even inverted, so as to seem to pass beneath the ophiolites. The indigenous and neptunian character of serpentines is maintained, while the plutonic hypothesis of their origin has been so far modified by its modern Italian advocates that they now suppose the serpentines to be due to submarine eruptions of a hydrous magnesian mud, which subsequently consolidated into serpentine and even into chrysolite. It is difficult to admit any other than a neptunian origin for the stratiform ophicalcites into which the massive serpentines often graduate. In a letter written in July 1878 to the author, but until recently mislaid, Gastaldi showed that the ophiolites of the Ligurian Apennines and of those of Prato were, like those elsewhere examined by him, protruding portions of the ancient *pietre verdi* zone, identical with that of the Alps, from which the Apennines cannot be distinguished either geologically or geographically. The vast series designated by him as the *pietre verdi* zone, according to Gastaldi, overlies the ancient central or primary gneiss (generally granitoid, but including quartzites and crystalline limestones with graphite, &c.), and has a thickness of many thousand metres, embracing three subdivisions. The lowest of these, sometimes called by him the *pietre verdi proper*, includes serpentines, diorites, euphotides, chloritic schists, &c.; the second is designated by him recent gneiss and granite with mica-schists and hornblendic rocks; while the third consists in great part of soft argillaceous or lustrous schists, with included quartzites, marbles, statuary, and banded dolomites and occasionally also serpentines, the presence of which led Gastaldi to include it with the two preceding subdivisions in his great *pietri verdi* zone; a name which the present writer, with Neri and others would restrict to the lower subdivision, regarded by him as the equivalent of the Huronian of North America; the underlying or central gneiss being the Laurentian; the recent gneiss and mica-schist, the Montalban or White Mountain series, and the upper subdivision, the Taconian or Lower Taconic of North America; the wholly distinct Upper Taconic being an uncrystalline series of fossiliferous Cambrian strata. The writer in this connexion recalled the work of Neri, Gerlach, and others in the western Alps, and that of Von Hauer and his associates in the Lombardo-Venetian Alps, where the same distinction of the true *pietre verdi* zone between the ancient gneiss below and the recent gneiss above had, unknown to him, been pointed out by the Austrian Geological Survey two years before the present writer in 1870 defined and named the younger gneissic series in North America. The absence of the true *pietre verdi* series in some localities, alike in the Alps and in North America, between the older and younger gneisses was noted, as well as the existence of apparent discordances between each one of the four great divisions of Archæan or pre-Cambrian crystalline rocks above named.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. A. E. Shipley, of Christ's College, has been appointed Demonstrator of Comparative Anatomy; Mr. H. F. Newall, of Trinity College, Demonstrator of Experimental Physics; and Messrs. L. R. Wilberforce and H. L. Callendar, both of Trinity College, Assistant-Demonstrators of Experimental Physics.

Dr. Peile has been elected Master of Christ's College, an election which all classes of University men, and reformers in particular, rejoice in.

A novelty is to be introduced in the education lectures next term, Dr. Francis Warner, of the London Hospital, having consented to give a course of six lectures on the physical and physiological study of children.

The next examination for Entrance Scholarships and Exhibitions at Gonville and Caius College will begin on December 10. Candidates must be under nineteen on that day.

Two scholarships of £80, and four others of £60 to £40, will be offered, with exhibitions. Candidates for Natural Science Scholarships may be examined in any of the following subjects: physics, chemistry, biology, and animal physiology, and will be expected to show proficiency in two of them, of which chemistry must be one. The tutors will forward full particulars on application.

We cannot find space for the long list of lectures in natural science now being given at Cambridge. Prof. Liveing gives a general course of principles of chemistry, and Prof. Dewar lectures on dissociation and thermal chemistry. Prof. Thomson lectures on electricity and magnetism, and on the applications of dynamical principles to physical phenomena. One of the courses of demonstrations at the Cavendish Laboratory is an advanced one on the properties of matter, and on sound. Prof. Lewis lectures on mineralogy, Prof. Stuart on mechanism. Mr. Marr lectures on principles of geology, Mr. Roberts on the palæontology of Echinoidea.

Dr. Vines lectures on the physiology of plants (advanced), Mr. Potter on the geographical distribution of plants.

Prof. Newton lectures on evolution in the animal kingdom; Mr. Gadow on the morphology of Ichthyopsida (recent and extinct); the Curator in Zoology, Mr. Cooke, on the geographical distribution of recent Mollusca.

Prof. Foster's, Dr. Lea's, and Mr. Langley's physiological courses are as usual. Prof. Macalister gives demonstrations on topographical human anatomy, as well as an elementary course.

Prof. Cayley's lectures this term are on quaternions and other non-commutative algebras; Prof. Darwin's on the orbits and perturbations of planets. Mr. Glazebrook lectures on hydrodynamics (waves and sound); Mr. Hobson on spherical and cylindrical harmonics; Mr. Larmor on electrostatics; Mr. Forsyth on modern algebra (binary forms); Dr. Besant on theory of equations and differential and integral calculus; Mr. H. M. Taylor on higher plane curves; Mr. Pendlebury on theory of numbers; Dr. Glaisher on elliptic functions; and Mr. Stearn on elastic solids.

SCIENTIFIC SERIALS.

American Journal of Science, September.—Notes on the geology of Florida, by William H. Dall. In this paper the results are given of two excursions to Southern and Central Florida undertaken in 1885 and 1887 by instruction of the Director of the United States Geological Survey. Special attention is devoted to the process of contemporaneous rock-formation now going on along the Gulf shores of West Florida, and to the Tertiary rocks which prevail so largely throughout the Peninsula. No coral or coral-reef formation was anywhere observed, and it is evident from these further researches that the hypothesis of Agassiz regarding the geological origin of this region can no longer be maintained.—Notes on the deposition of scorodite from arsenical waters in the Yellowstone National Park, by Arnold Hague. The occurrence of this comparatively rare mineral as a deposition from thermal mineral springs is here noticed for the first time. It is found in several localities in the Yellowstone Park as an incrustation deposited from the waters of several hot springs and geysers, and is especially abundant at the Joseph's Coat Springs on Broad Creek, east of the Grand Cañon. The analysis—yielding Fe_2O_3 34·94, As_2O_5 48·79, and H_2O 16·27—shows this mineral to be true scorodite, a hydrous arsenate of iron, the layers varying from a mere coating to an eighth of an inch in thickness. Wherever observed it occurs as an amorphous deposit, and when pure, leek green in colour.—The effects of magnetization on the viscosity and the rigidity of iron and steel, by C. Barus. An attempt is made in this memoir to verify by a static method the results recently communicated by Mr. Herbert Tomlinson on the changes of viscosity and of elasticity produced by magnetizing iron. It is shown that the increment of rigidity due to magnetization increases at an accelerated rate as the soft, temporarily twisted wire becomes more nearly filamentary. A series of results is also given on the rigidity of magnetized steel temporarily strained and varying in temper from extreme hard to extreme soft. A main object of the paper is to show how the principles here established may